MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016 SESSION

PTG 0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

10 MARCH 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all workings.

Question 1

(a) Derive the identity $\sin^2\theta+\cos^2\theta=1$. [4 marks]

(b) (i) Verify the identity $\dfrac{\cos 2x}{1-\sin 2x}=\dfrac{1+\tan x}{1-\tan x}$. [7 marks]

(ii) Using the identity in (b)(i) above or other method, solve $\dfrac{\cos 2x}{3(1-\sin 2x)}=1$ on the interval $0\le x<2\pi$. [8 marks]

(c) A fire at F is spotted from two fire lookout stations, A and B, which are 10 km apart. Station B reports the fire at angle $ABF = 53°$ and station A reports the fire at angle $BAF = 28°$. Which station is closer to the fire? Sketch a diagram for the problem. [6 marks]

Question 2

(a) Solve $(3x+2i)+(5+yi)=-2-i$ for real numbers x and y. [4 marks]

(b) Simplify $i^{32}+i^{21}$. [2 marks]

(c) Convert $-10+3i$ to polar form. Express the argument in radians. Then, find all the cube roots of $-10+3i$ in rectangular form. [8 marks]

(d) The coordinates of points A, B, and C are (–1, 0, 1), (2, 2, 2) and (3, –1, 3) respectively.

(i) Find $\overrightarrow{AB}$ and $\overrightarrow{BC}$. [4 marks]

(ii) Without using dot or cross products, determine whether $\overrightarrow{AB}$ is parallel to $\overrightarrow{BC}$ or not. [3 marks]

(e) Vectors $\underset{\sim}{u}$ and $\underset{\sim}{v}$ are $\langle 3,5,6\rangle$ and $\langle -6,-1,2\rangle$ respectively. Find $\underset{\sim}{u}\bullet\underset{\sim}{v}$ and $\underset{\sim}{u}\times\underset{\sim}{v}$. [4 marks]

Question 3

(a) Find the equation of the line that is perpendicular to the line $y = 100$ and contains the point (–1, 5). [1 mark]

(b) Line l_1 passes through points A (3, 4) and B (–2, 10).

(i) Find the equation of line l_1 in slope-intercept form. [3 marks]

(ii) Determine if point $C\left(-5,\dfrac{182}{5}\right)$ is on line l_1. [2 marks]

(c) The equation of an ellipse is $2x^2+3y^2+20x+60y+344=0$. Find the centre, foci and vertices of the ellipse. [11 marks]

(d) The equation of a parabola is $x^2+4x+8y-36=0$.

(i) Find the vertex and focus of the parabola. [6 marks]

(ii) Write the equations for the axis of symmetry and directrix of the parabola. [2 marks]

Continued...

Question 4

(a) If $A=\begin{bmatrix}1 & -5\\ 2 & 5\end{bmatrix}$, $B=\begin{bmatrix}-1\\ 10\\ 2\end{bmatrix}$, $C=\begin{bmatrix}0 & 10 & 8\\ -5 & -1 & 1\end{bmatrix}$, and $D=\begin{bmatrix}4 & 3 & -3\end{bmatrix}$, find

(i) AC [2 marks]
(ii) $2B+3D^{T}$ [2 marks]
(iii) CB [2 marks]
(iv) $A-B$ [1 mark]

(b) Find x and z in the following linear system using Cramer's rule.

$$\begin{aligned}3x-7y+z&=1\\ -x+y+2z&=5\\ x+5y-4z&=-5\end{aligned}$$ [10 marks]

(c) Find matrix A if

$$A\begin{bmatrix}0 & -1 & 3\\ 2 & 2 & 2\\ -4 & 1 & 2\end{bmatrix}=I_3$$ [8 marks]

Continued...

APPENDIX

$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

$$\cos(A+B)=\cos A\cos B-\sin A\sin B$$
$$\cos(A-B)=\cos A\cos B+\sin A\sin B$$
$$\sin(A+B)=\sin A\cos B+\cos A\sin B$$
$$\sin(A-B)=\sin A\cos B-\cos A\sin B$$
$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$
$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

$$\sin 2A=2\sin A\cos A$$
$$\cos 2A=\cos^2 A-\sin^2 A$$
$$=2\cos^2 A-1$$
$$=1-2\sin^2 A$$
$$\tan 2A=\frac{2\tan A}{1-\tan^2 A}$$

$$\sin^2 A=\frac{1-\cos 2A}{2}$$
$$\cos^2 A=\frac{1+\cos 2A}{2}$$
$$\tan^2 A=\frac{1-\cos 2A}{1+\cos 2A}$$
$$\tan A=\frac{\sin 2A}{1+\cos 2A}$$
$$=\frac{1-\cos 2A}{\sin 2A}$$

$$\sin A\cos B=\frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$$
$$\cos A\cos B=\frac{1}{2}\left[\cos(A-B)+\cos(A+B)\right]$$
$$\sin A\sin B=\frac{1}{2}\left[\cos(A-B)-\cos(A+B)\right]$$

$$\sin A+\sin B=2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\sin A-\sin B=2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\cos A-\cos B=-2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

End of page